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Forest Insect & Disease Management
Pacific Northwest Region

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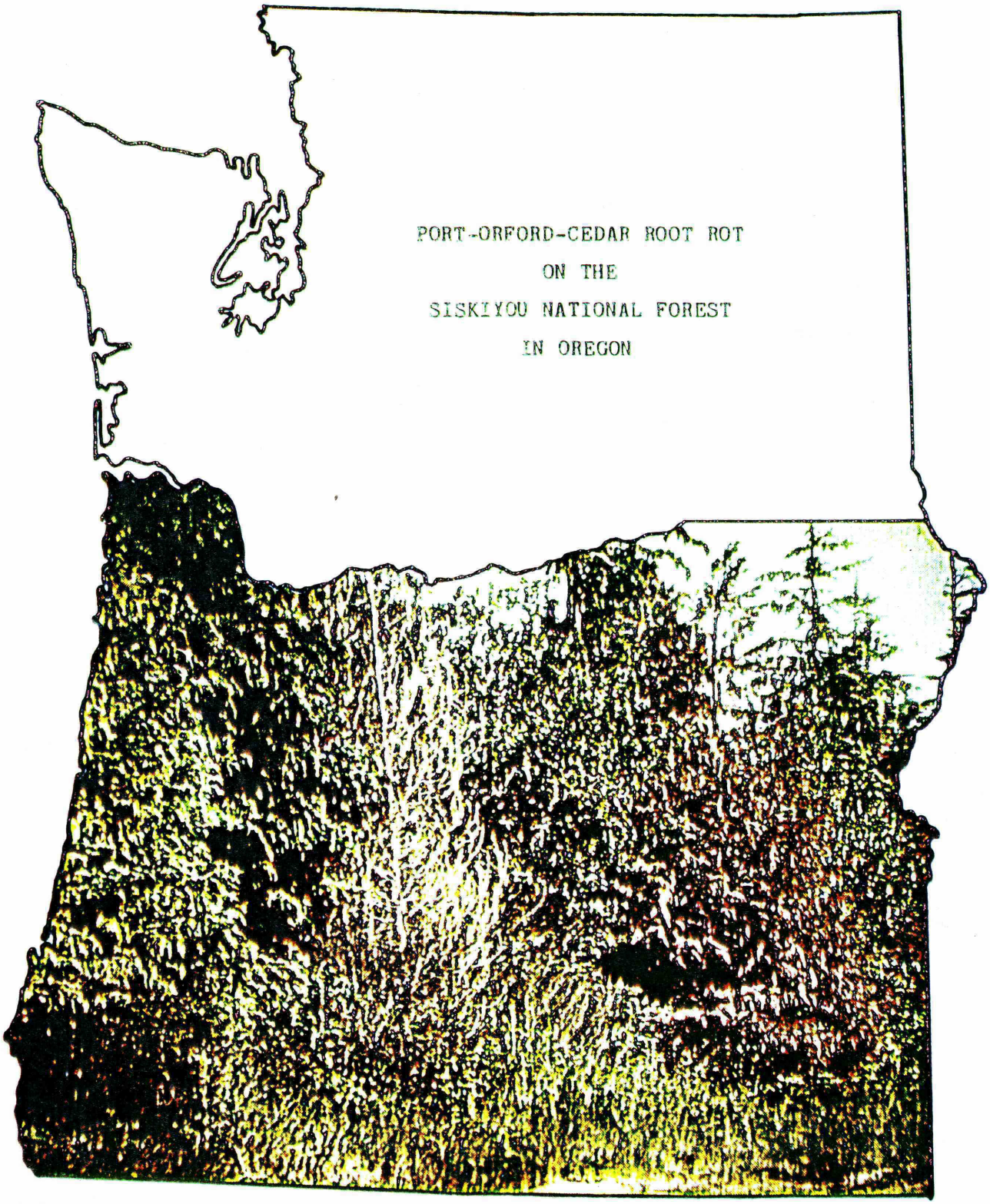

PORT-ORFORD-CEDAR ROOT ROT
ON THE
SISKIYOU NATIONAL FOREST
IN OREGON

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PORT-ORFORD-CEDAR ROOT ROT ON THE SISKIYOU NATIONAL FOREST IN OREGON

By

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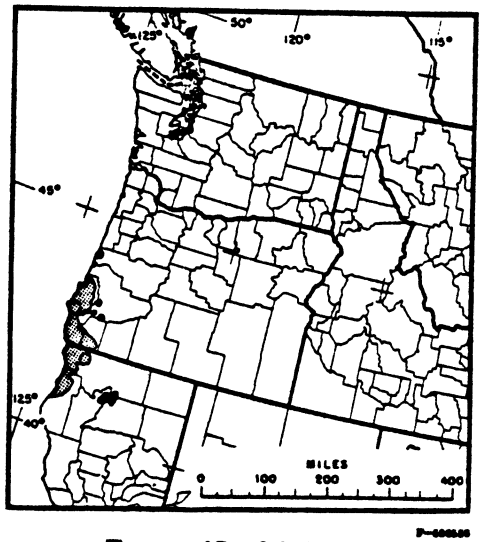
INTRODUCTION

Port-Orford-cedar root rot, caused by the fungus Phytophthora lateralis, Tucker and Milbrath, has apparently been killing Port-Orford-cedar in the Pacific Northwest for more than 60 years. Although the causal fungus was not actually identified until 1942, it is known to have occurred in the Willamette Valley in 1937 (Hunt 1959), and there is strong evidence that it was causing losses in the Puget Sound area as early as 1922 (Hunt 1957). Roth et al (1957) suggests that a 1907 publication discussing a fungus in sapling stage Port-Orford-cedar probably refers to P. lateralis since young cedars are singularly free of diseases with the exception of Phytophthora.

In 1952, saplings in the city of Coos Bay were found to be infected and, within 2 years, the disease had spread 75 miles along the coast (Trione 1956). While the subsequent spread was not so dramatic, P. lateralis has continued to expand within the host range (Figure 1) as evidenced by the records of numerous detection surveys. Aerial photographs showed a network of spread along roads and highways, along ditches and natural watercourses, around farmsteads, along stock trails to wooded hill pastures, and where earth-moving construction had taken place (Roth 1963).

Figure 1.



The range of Port-Orford-cedar.
(Map from Fowells, 1965)

The entire range of Port-Orford-cedar is not infested. Many areas have not been infested, and a substantial portion of the host range may not be conducive to long-term survival of P. lateralis. This may particularly be the case for Port-Orford-cedar on serpentine soils in the relatively dry eastern portion of its natural range.

The purpose of this evaluation is to describe the epidemiology of Port-Orford-cedar root rot, document the location of root disease along the road system of the Siskiyou National Forest, and present some biologically sound options for management of Port-Orford-cedar. These options are presented as an aid to land managers in making decisions based on site-specific considerations.

DISEASE EPIDEMIOLOGY

Phytophthora lateralis is one of several plant pathogenic species in the genus and, in forest conditions, is pathogenic only to species in the genus Chamaecyparis. Port-Orford-cedar is most susceptible and, once individuals are infected, death is seemingly inevitable.

The fungus produces several structures that have different functions. Mycelium grows in host roots, apparently incapable of extensive growth in unsterilized soil. Once roots become infected, spread within the root system of an individual tree is by mycelial growth. Chlamydospores are durable survival structures produced on mycelium within host tissues. Their function is to ensure survival of the fungus during hot, dry summer months. Chlamydospores germinate in the fall and early winter with the onset of cool soil temperatures and increased soil moisture. Germinating chlamydospores produce sporangia. Sporangia are sac-like reproductive organs that produce and disseminate zoospores. Zoospores are aquatic spores capable of swimming in water. In the absence of water, they perish. Zoospores are responsible for initiating all new host infections either by direct invasion of succulent root tips or, rarely, by infecting foliage in contact with infested soil. This is in contrast to spread of infection within a host, or to a new host which may occur through root contact. Oospores are sexually-produced durable spores that, like chlamydospores, serve to carry the fungus through hot, dry seasons.

Infection takes place almost exclusively in the roots by zoospores. Healthy, intact root tips can be invaded by the fungus. The zoospores are chemically attracted to root tips. The inner bark and cambium are killed as the fungus gradually grows up the roots toward the base of the tree. Usually, by the time the disease is evident at the root collar, most of the roots have been colonized and the tree is dying. Other agents, particularly insects, often invade the dying trees. After an infected tree dies, chlamydospores and oospores are produced in the dead tissues. Later they will germinate, and zoospores will be released into soil water, resulting in an increase in inoculum and downslope spread.

In attacked roots, evidence of infection is a cinnamon-brown discolored zone in the cambium, sharply delimiting the healthy tissue (Figure 2). Often, a dark, almost black, resinous band is visible in the inner bark close to the cambium. Just prior to tree death, the discolored zone may extend upward in the main bole 2 to 5 feet above the ground.

The first external evidence of the disease is a slight yellowish discoloration of the foliage (Figure 3). Attacked trees have an off-color appearance. Natural stands of Port-Orford-cedar characteristically have many color forms, varying from blue-green to yellow-green. The foliage in off-color trees gradually takes on a yellowish, withered appearance within a few weeks to months, depending on weather conditions and tree size. Then progressive color changes occur, first to yellow, then bright red, then red-brown, and finally, brown (Figure 4). Two or 3 years after death, trees are usually completely defoliated. In areas where the disease has been active for several years, dead and dying trees with all degrees of foliage symptoms are visible, from bare, older kills, to trees exhibiting the first signs of stress (Figure 5). Good evidence of the presence of the fungus in roots or root collars usually can be found in trees that are off-color, yellow, or bright red. In older kills, all the bark tissue is brown and often full of insect galleries.

Most disease spread is accomplished by the motile zoospores. Zoospores can swim short distances in soil water or be carried longer distances in moving surface water. Percolation of infested surface water into soil can result in infection of Port-Orford-cedar root tips. Spread within infected trees and from tree to tree along grafts is by mycelial growth. Passive spread of the fungus occurs when infested soil is moved. Chlamydospores and oospores can survive in clods of soil. Vehicles with soil on wheels and various other parts can move the fungus long distances. Animals can also move the fungus when soil adheres to their feet. Once the fungus is moved to another area in soil, germination takes place with the onset of cool wet weather, and local-spread by water drainages becomes important in buildup of the disease and movement downslope.

P. lateralis is very dependent upon free water for spread and infection. The disease is most prevalent along streambanks, watercourses, and wet sites. Concave sites with Port-Orford-cedar are vulnerable to infection since they are easily flooded, while convex slopes offer a lower level of vulnerability because of water channelling. Cedar on topography that quickly channels surface water is less vulnerable to damage than cedar on broad slopes.

Port-Orford-cedar is a frequent and prolific seed producer. It readily regenerates in shade. When openings are created by logging, tree mortality, or other disturbances in stands containing Port-Orford-cedar, cedar typically regenerates in them. The disease has seldom, if ever, by its own action, eliminated Port-Orford-cedar from infested stands.

SURVEYS

Historically, many surveys have been conducted to determine the extent and/or rate of spread of Port-Orford-cedar root rot. These have included aerial photography and roadside surveys. Roadside surveys are considered a viable approach since human activities were shown to be the major vector (Roth 1963).

During the fall of 1983, Siskiyou National Forest personnel conducted a roadside survey of known Port-Orford-cedar areas to map the current location of the disease. The survey involved driving all National Forest roads known to bisect Port-Orford-cedar areas and recording, in red, portions of road showing dead or dying cedars. Infected segments of road separated by less than 1/4-mile were considered contiguous and so indicated on maps. Distances were

Figure 2.--Discolored cambium/inner bark of P. lateralis-infected Port-Orford-cedar.

Figure 3.--Slight discoloration symptom of early Port-Orford-cedar root rot.

Figure 4.--Foliage browning in final stages of Port-Orford-cedar root rot.

Figure 5.--All stages of Port-Orford-cedar root rot symptoms.

determined with a map-measuring tool. Of the 318 miles of Port-Orford-cedar roadside surveyed, approximately 35 percent (113 miles) contained dead and/or dying cedars. (Appendix Maps 1983-1-7).

Observation by Siskiyou National Forest and FPM personnel indicate a marked increase in areas with dead Port-Orford-cedars during the past decade.

The seriousness of this problem and potential for significant additional losses indicates a need to formulate prescriptions for land managers to use in making future management decisions. The following sections outline our recommendations based on previous research information and site-specific survey data.

MANAGEMENT CONSIDERATIONS

Port-Orford-cedar will be managed on the Siskiyou National Forest. Because of the relatively long rotation needed for high quality timber (up to 200 years), and the high susceptibility of cedar to the disease once the fungus is introduced into an area, long-term commitments to disease management practices will have to be made. Commitments at a minimum will have to be made for entire rotations where management of significant quantities of cedar is a goal.

At the present time, the only known way of eliminating the disease from an infested area is total removal of the host for several years. This length of time is not scientifically known but is suspected to be a minimum of 3 to 5 years, with 5 being more likely.

There are fungicides available for preventing infections of host plants by members of the genus Phytophthora, and one, metalxyl, has shown effectiveness in preventing Port-Orford-cedar root rot[1/]. It is extremely unlikely that fungicides could ever be used to protect Port-Orford-cedars in forest stands because application technology is not available and cost probably would be prohibitive since yearly applications would be required.

Port-Orford-cedars genetically resistant to the disease have never been identified among the thousands screened. Research is underway to develop a reproducible, quantifiable procedure to evaluate seedlings for resistance. This will be a long-term effort, and there is no assurance that resistant trees will be found.

Man has been the major vector of P. lateralis. The disease has been spread by moving infected planting stock to uninfested sites. Earth-moving equipment and logging machinery move infested soil to uninfested areas. Salvage-logging of dead and dying cedar, then moving to clean stands without cleaning the

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1/ This publication reports research involving pesticides. It does not contain recommendations for their use nor does it imply that the uses discussed here have been registered. All pesticides must be registered by appropriate State and/or Federal agencies before they can be used.

equipment, spreads the disease. Casting infested gravel into drainage ditches and over road birms during road maintenance results in spread downslope. Locating roads above stands of Port-Orford-cedar usually results in infection of the cedar. Placement of culverts that drain over broad slopes instead of quickly into well-defined drainages enhances disease spread. Cleaning culverts and hauling the debris to uninfested areas cause disease spread.

Phytophthora lateralis is totally dependent upon free water for spread and infection, and on man for long distance spread. These facts must be the foundation of a Port-Orford-cedar root rot management program. Because chemical controls and genetically resistant trees are not yet available and may not be for many years, if ever, the most effective management option is to minimize contact between the fungus and host.

Critical to managing Port-Orford-cedar is knowing where the disease is. Maps showing locations must be kept up-to-date and used. Man has unfortunately been effective in spreading this disease in the past, and spread in the future is inevitable. But knowledge of where the disease is can help slow the spread to clean areas and may prevent clean areas from ever becoming infested.

Another critical step is to decide where Port-Orford-cedar can be managed. Some areas are especially vulnerable to infection because of their location. Such sites include stands downslope (especially concave) or downstream from infected trees, trees adjacent to and downslope from infested gravel roads, and sites in poorly drained areas. Management of Port-Orford-cedar should be concentrated on areas where contact with the pathogen will be minimal. Dr. Lewis Roth has described these areas as Port-Orford-cedar production sites (unpublished report). These sites are characterized by 1) being upslope from infested areas or areas likely to become infested, 2) having limited access through and upslope from them, and 3) receiving no drainage water from infested areas.

Restricting movement and activities of vectors, principally man, could take two forms, active or passive. Active restrictions would include closing roads to travel, requiring dry season harvesting, and cleaning of all vehicles before they leave infested areas or enter clean areas. Passive restrictions would take the form of locating Port-Orford-cedar production areas in sites where there is little or no reason for people and their vehicles to be present. There would be no deliberate actions to keep people from these areas, neither would there be any attractions to draw them there.

Active restrictions are viewed as not practical to implement. These restrictions would have to remain in effect for long periods of time, maybe in perpetuity in some cases. A majority of the public would support the restrictions such as gating, but some would resort to such actions as destroying gates to gain access to closed sites. In addition, there are over 2600 miles of roads on the Siskiyou, many of which travel through stands containing Port-Orford-cedar. Closure of even a small percentage of the road network is probably not feasible.

MANAGEMENT ALTERNATIVES

Port-Orford-cedar occurs over much of the Siskiyou National Forest, but infrequently in pure stands. In most cases it is a minor stand component. We recommend that sites containing cedar be classified as either Port-Orford-cedar production areas or not. Cedar production sites as previously described would be in locations where contact with inoculum would be minimal and passive restrictions on human activities are feasible. In addition there would be enough cedar present, or potentially present, to justify costs associated with managing for cedar. Sites not designated as cedar production areas would be sites that are vulnerable to infection that could not be prevented at reasonable costs, or sites that contain such a minor amount of cedar that special management practices are impractical.

Following is a discussion of suggested management practices for Port-Orford-cedar root rot.

Port-Orford-cedar production areas - Uninfested

These areas should be upslope from roads and not receive drainage water from infested sites. Roads should be located to avoid clean cedar production areas. In precommerical stands, individual cedars should be spread at least 25 feet apart, or clumps of cedar should be widely spaced to minimize root grafting. Cattle and other livestock should be managed to avoid grazing in cedar production areas. The only occasions when ground based harvesting equipment such as bulldozers, skidders, and other devices, excluding trucks, capable of moving soil, would enter cedar production sites, are during timber harvesting. Soil on this equipment should be removed with high pressure hoses or steam before equipment is allowed to enter the areas. The equipment should remain in the area for the entire operation or else be cleaned again prior to reentry. Since it will be impractical to clean the numerous trucks travelling to and from the area, logs should be yarded to landings on or near existing roads located below cedar production areas. Cable logging and helicopter logging should be looked at as an alternative to building roads. If roads have to be built in cedar production areas, it is highly probable that areas downslope from them will become infested. This will mean the boundaries of the cedar production area will have to be modified to reflect the disease occurrence. The location of cedar production areas must be well documented on Forest records. Any proposed actions in the areas must not jeopardize the cedar.

Even if all these actions are implemented, it is likely that some of the cedar production areas will become infested by *P. lateralis*. The suggested management actions must not be viewed as guarantees that the target areas will be kept free of the disease. They should be considered as reducing the probability of disease introduction and buying time.

Port-Orford-cedar production areas - Infested

The amount of infection in cedar production areas would have to be minor, and the site should have physical features that minimize contact between host and pathogen; otherwise, it should not be classified as a cedar production area. The same considerations as described for clean cedar production areas would apply. In addition, all infected trees and adjacent trees in vulnerable microsites should be killed. They should only be removed where removal operations will not spread the pathogen into noninfected areas.

The disease should not be ignored in sites not in Port-Orford-cedar production areas. Cedar will not be written off as a lost cause on these sites. However, because of their physical features, it will not be possible to prevent or eliminate the disease from these sites.

Sites not in Port-Orford-cedar production areas - Uninfested

Although the disease will probably eventually be introduced into these areas, it is possible to delay its introduction by utilizing the following practices.

Ground-based harvesting equipment carrying clods of soil should be cleaned with high-pressure hoses before operating in uninfested areas with economically important volumes of Port-Orford-cedar. Culverts should direct water quickly into well-defined drainage channels. When precommercial thinning, favor other tree species within a 15-meter-wide band below roads and 10 meters on both sides of drainage likely to carry infested water. Favor other tree species in wet areas and on concave slopes. Space cedar at least 25 feet apart and do not depend upon cedar to comprise more than 20 percent of the desired stocking. Maintain full stocking with other tree species, such as Douglas-fir and hemlock, and retain cedar as an excess since it will grow in the shade of these other species. If the cedar is to be maintained through a second rotation of associated species, strict sanitary conditions must also be maintained.

Sites not in Port-Orford-cedar production areas - Infested

Salvage all merchantable dead and dying trees and healthy-appearing trees in vulnerable microsites with one entry. Avoid repeated salvage entries into the same site because this action perpetuates survival of the pathogen and increases the probability of spread to other sites. Favor other tree species during thinning and regeneration. Restrict cedar to convex slopes that do not receive infested drainage water. This can be accomplished during precommercial thinning. Do not move soil and debris to clean sites. Forest Service personnel should tell forest operators about the disease and suggest they hose off equipment before moving it to other sites regardless of the ownership of sites to be worked in the future. If the equipment is to be moved directly to another infested site there would be no need to clean it. Forest operators could be told about the disease with a leaflet that FPM would prepare.

- REFERENCES -

Batini, F. and J. N. Cameron.
1971. Some aspects of logging hygiene. For. Rept. of N. Australia. Res. Pap. No. 3, p. 7.

Fowells, H. A.
1965. Silvics of forest trees of the United States. USDA FS Ag. Hdbk. 271.

Gordon, Donald E. and Lewis F. Roth.
1976. Root grafting of Port-Orford-cedar - An infection route for root rot. For. Sci. 22(3):276-278.

Hunt, John.
1957. Early history of Port-Orford-cedar root rot. Off. Rpt.

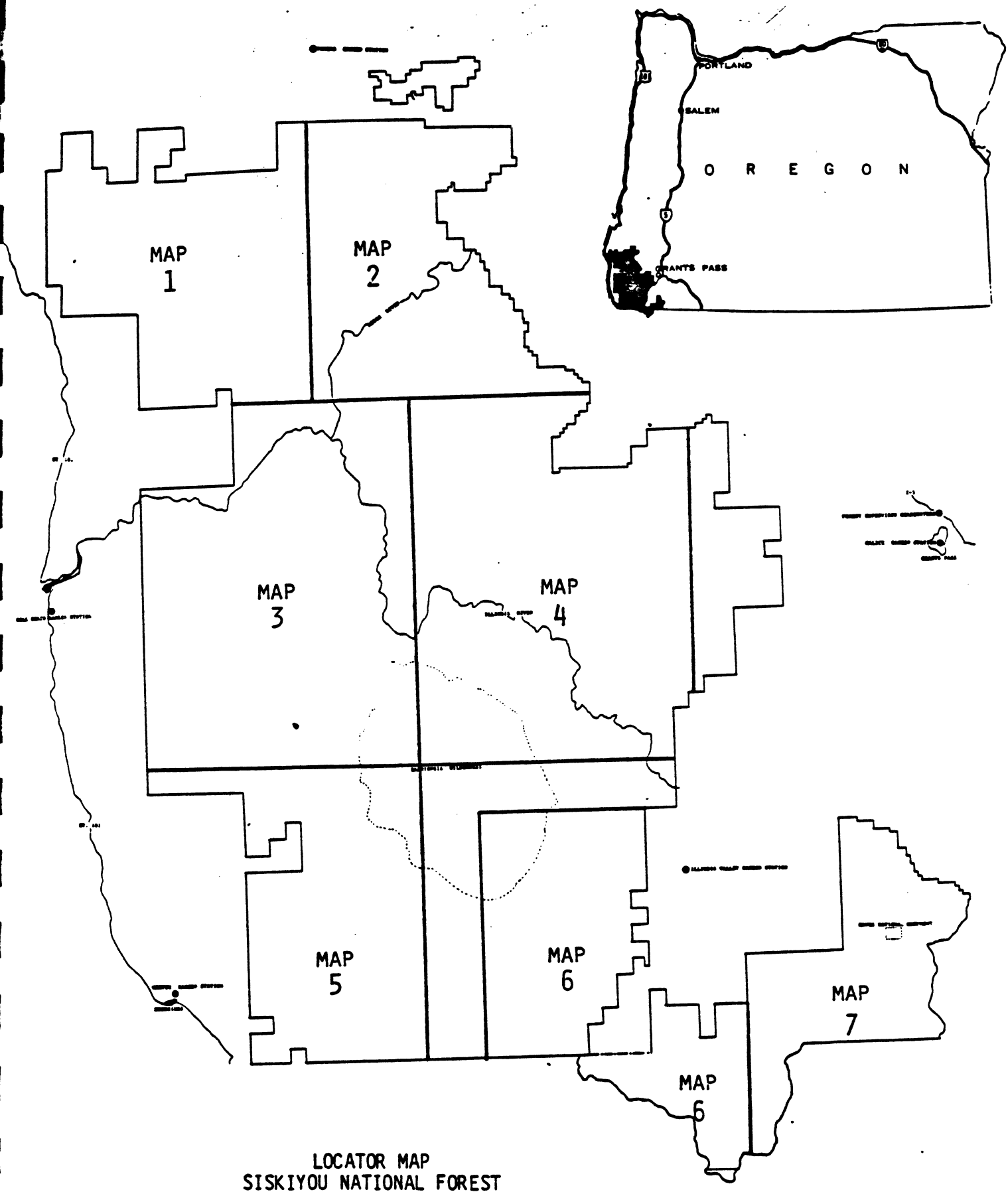
Hunt, John.
1959. Office report: Phytophthora lateralis on Port-Orford-cedar. Off. Rpt.

Roth, L. F., Edward J. Trione, and William H. Ruhmann.
1957. Phytophthora-induced root rot of native Port-Orford-cedar. J. For. 55(4):294-298.

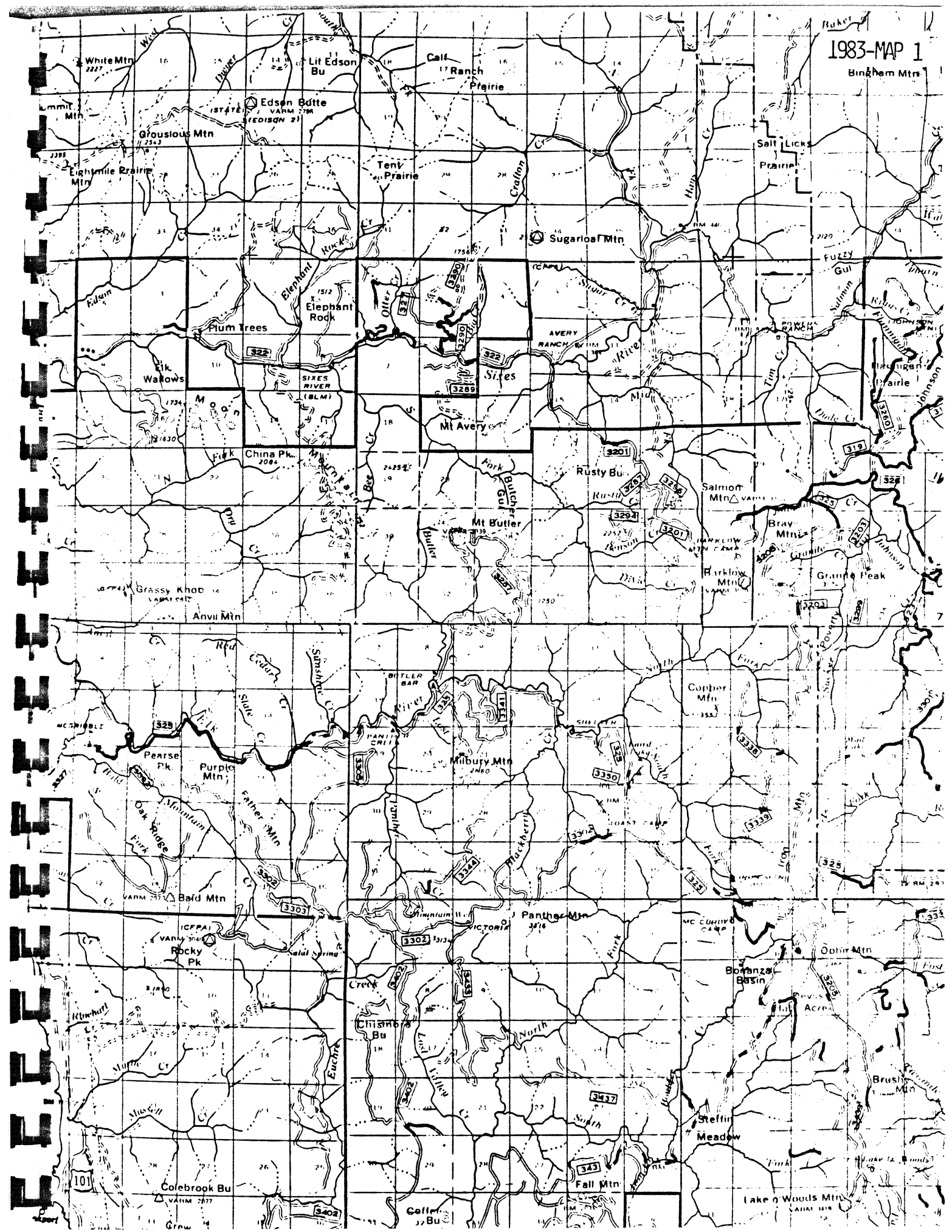
Roth, L. F.
1963. Phytophthora cinnamomi root rot of Douglas-fir. Phytopath 53(10) 1128-1131.

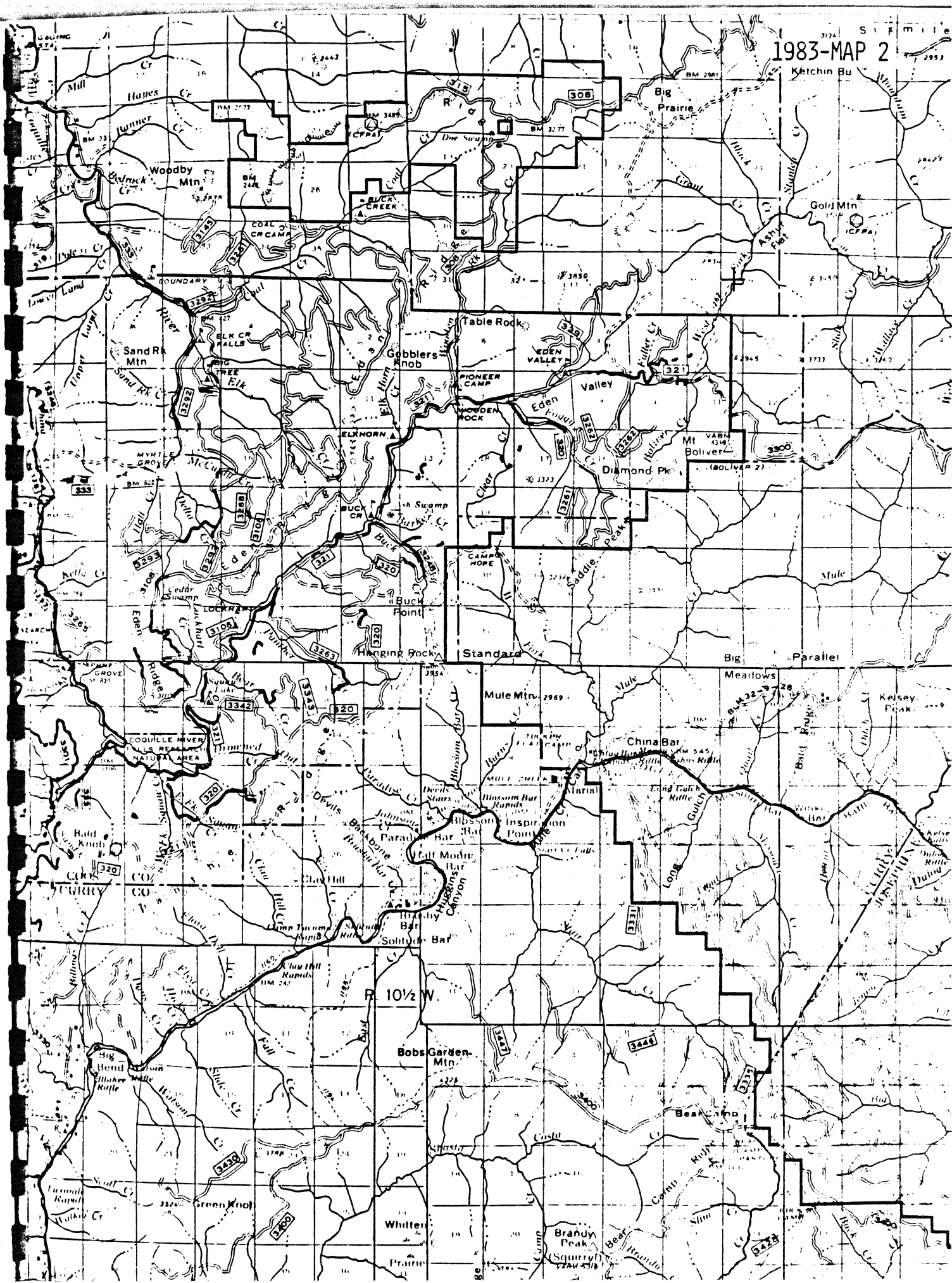
Trione, E.
1956. A brief history and description of the Phytophthora disease of Port-Orford-cedar. Off. Rpt.

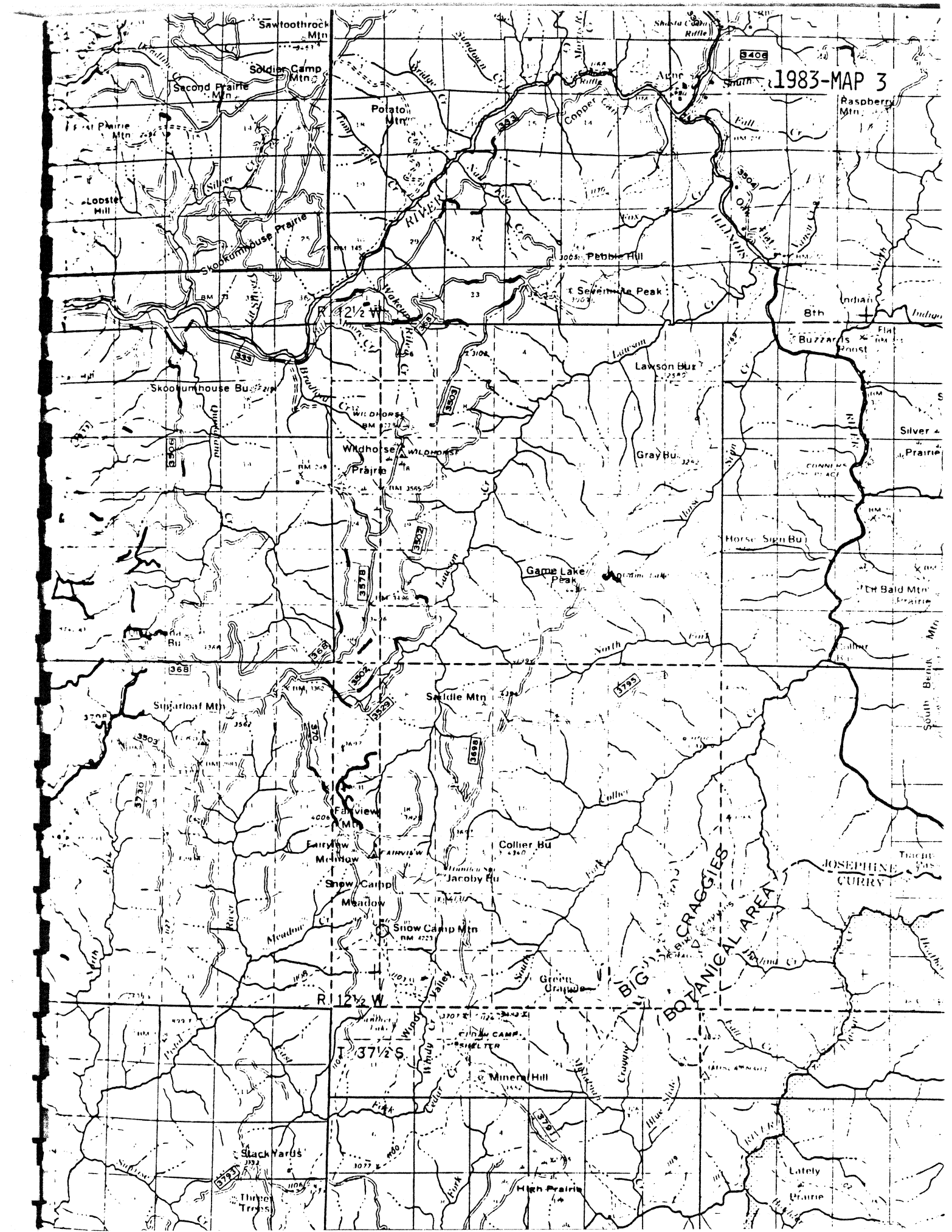
Trione, E. J. and L. F. Roth.
1957. Aerial infection of Chamaecyparis by Phytophthora lateralis. PDR 41(3):211-215.

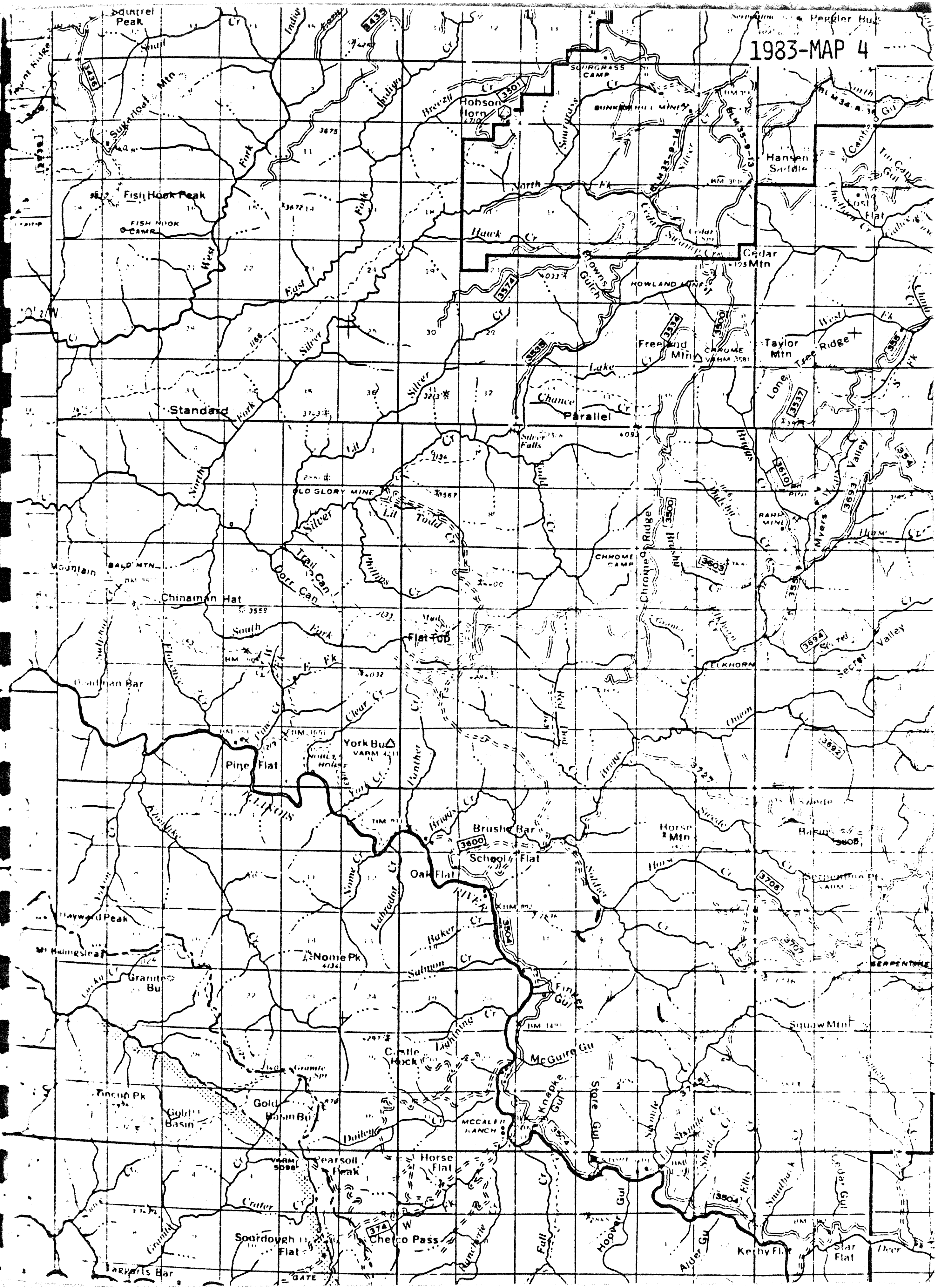


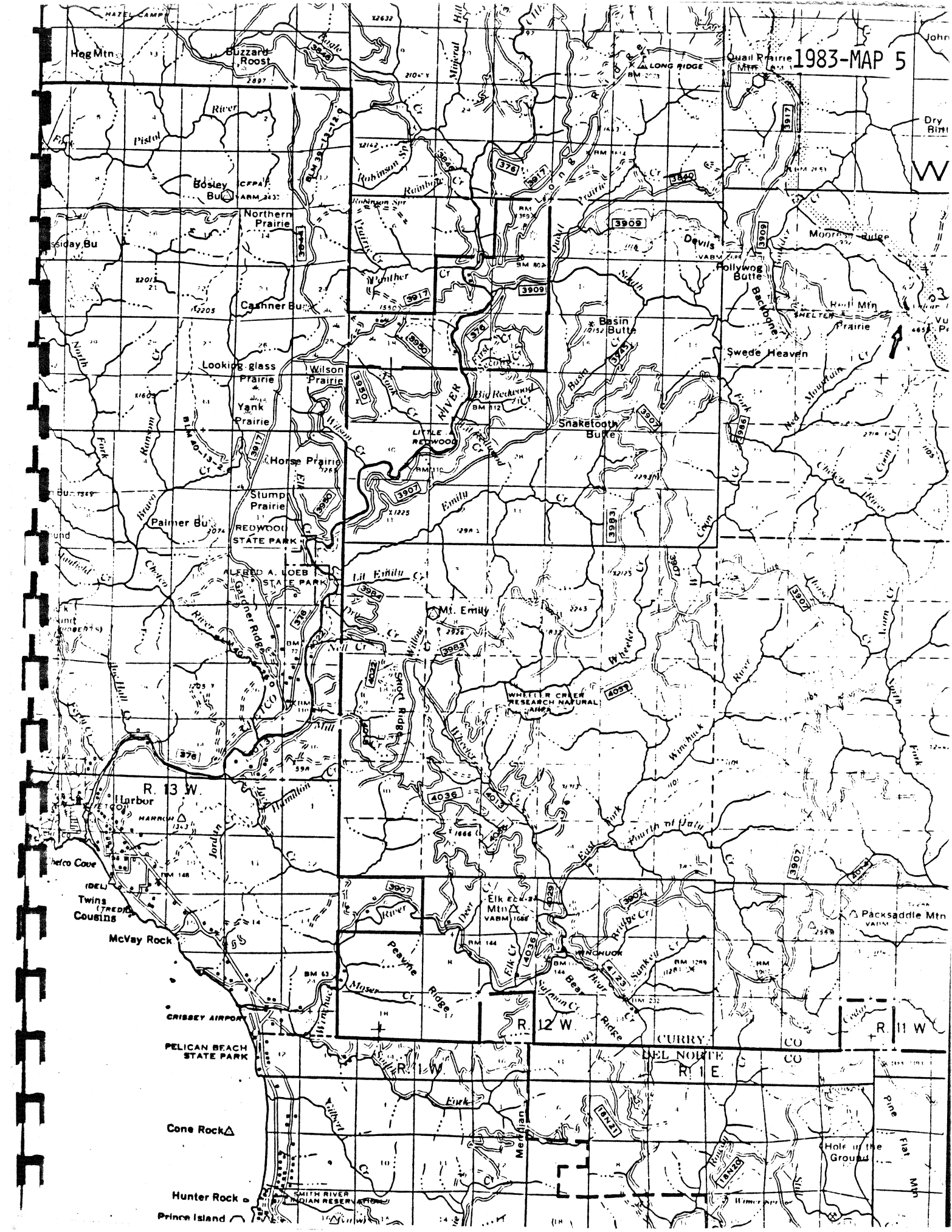
LOCATOR MAP
SISKIYOU NATIONAL FOREST
1974/1983 PORT-ORFORD-CEDAR
ROOT ROT SURVEYS

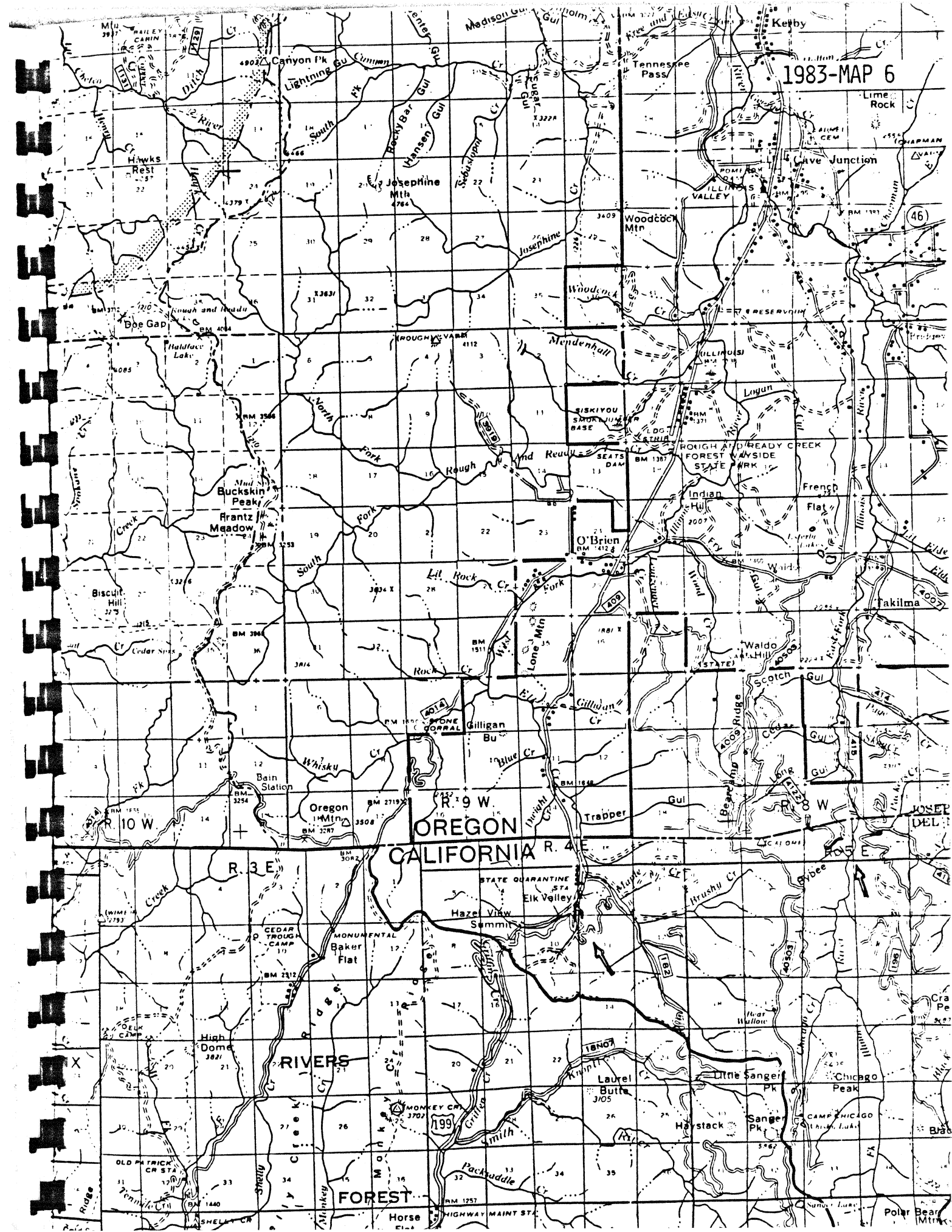

1983-MAP 1
White Mtn
Lit Edson Bu
Edson Butte
Calf Ranch Prairie
Bingham Mtn
Grousious Mtn
Eightmile Prairie Mtn
Tent Prairie
Salt Licks Prairie
Sugarloaf Mtn
Fuzzy Gul
Elephant Rock
Plum Trees
Elk Wallows
SIXES RIVER (BLM)
Sixes
AVERY RANCH
Mt Avery
China Pk
Rusty Bu
Salmon Mtn
Mt Butler
Bray Mtn
Barklow Mtn
Grassy Knob
Anvil Mtn
Pearse Pk
Purple Mtn
Milbury Mtn
Copher Mtn
Bald Mtn
Rocky Pk
Panther Mtn
Chisholm Bu
Bonanza Basin
Steffin Meadow
Fall Mtn
Colebrook Bu
Lake o' Woods Mtn

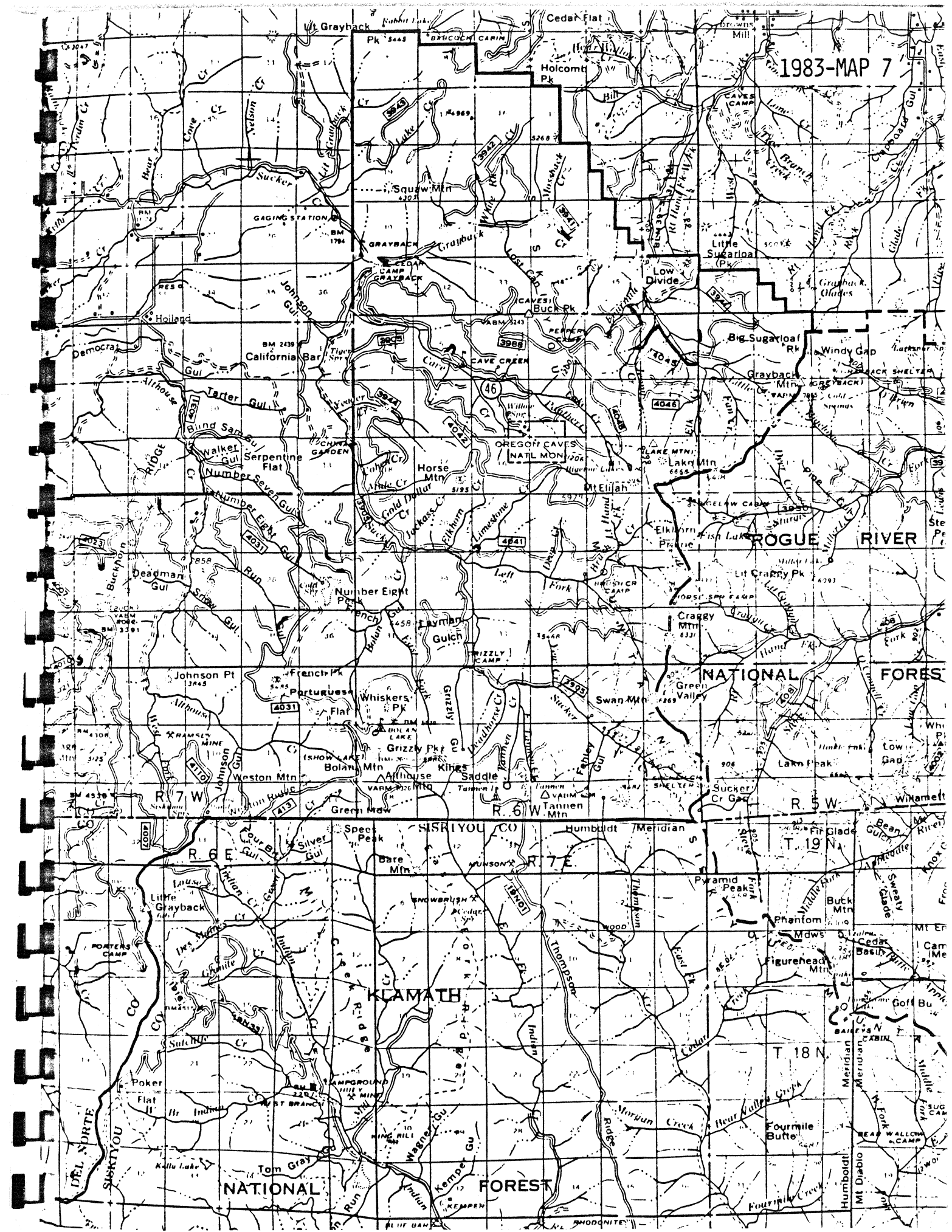

1983-MAP 2
Woodby Mtn
Big Prairie
Gold Mtn
Table Rock
Gobblers Knob
Sand Rk Mtn
Eden Valley
Mt Bolivar
Diamond Pk
Buck Point
Hanging Rock
Standard
Mule Mtn
China Bar
Bobs Garden Mtn
Bear Camp
Brandy Peak
Green Knob
R. 10½ W.


1983-MAP 3
Sawtoothrock Mtn
Soldier Camp Mtn
Second Prairie Mtn
Potato Mtn
Raspberry Mtn
Lobster Hill
Skookumhouse Prairie
RIVER
Pebble Hill
Seven Mile Peak
R 12½ W
Buzzards Roost
Lawson Bu
Skookumhouse Bu
Wildhorse Prairie
Gray Bu
Silver Prairie
Horse Sign Bu
Game Lake Peak
Bald Mtn
Saddle Mtn
Sugarloaf Mtn
Fairview Mtn
Fairview Meadow
Collier Bu
Jacoby Bu
Snow Camp Meadow
Snow Camp Mtn
BIG CRAGGIES BOTANICAL AREA
JOSEPHINE CURRY
Green Mountain
Windy Valley
T 37½ S
Snow Camp Shelter
Mineral Hill
Blue Slide
Lately Prairie
High Prairie
Slack Ya Us
Three Trees


1983-MAP 4
Squirrel Peak
Sugarloaf Mtn
Fish Hook Peak
FISH HOOK CAMP
Hobson Horn
SOURGRASS CAMP
BUNKER HILL MINE
Hansen Saddle
Lost Flat
Hawk Cr
Cedar Mtn
Browns Gulch
HOWLAND MINE
Freeland Mtn
CHROME
Taylor Mtn
Lone Tree Ridge
Standard
Parallel
Chance Cr
Lake Cr
Silver Falls
OLD GLORY MINE
Silver Cr
Lil Todd Cr
Mountain
BALD MTN
Chinaman Hat
Trail Can
Dorr Can
Phillips Cr
CHROME CAMP
Chrome Ridge
South Fork
Flat Top
Secret Valley
ELKHORN
Deadman Bar
Pine Flat
York Bu
Clear Cr
Panther Cr
ILLINOIS
Brushy Bar
School Flat
Oak Flat
Horse Mtn
Nome Cr
Labrador Cr
RIVER
Heyward Peak
Mt Billingslea
Granite Bu
Nome Pk
Salmon Cr
Baker Cr
Florence Cr
Finley Gul
SERPENTINE
Squaw Mtn
Lightning Cr
Castle Rock
McGuire Gu
Knapke Gul
Store Gul
Tincup Pk
Gold Basin
Gold Basin Bu
MCCALEB RANCH
Pearsoll Peak
Horse Flat
Crater Cr
Sourdough Flat
Chetco Pass
Full Cr
Hoover Gul
Alder Gu
Kerby Flat
Star Flat
Taggarts Bar
GATE


1983-MAP 5
Hog Mtn
Buzzard Roost
Quail Prairie Mtn
LONG RIDGE
Dry Rim
Bosley Bu
Northern Prairie
Devils
Hollywog Butte
Moore Ridge
Backbone
Cashner Bu
Basin Butte
Swede Heaven
Lookingglass Prairie
Wilson Prairie
Yank Prairie
Big Redwood
LITTLE REDWOOD
Snakefoot Butte
Horse Prairie
Stump Prairie
Palmer Bu
REDWOOD STATE PARK
ALFRED A. LOEB STATE PARK
Gardner Ridge
Mt. Emily
WHEELER CREEK RESEARCH NATURAL AREA
Short Ridge
Wheeler
Wimhuck
R. 13 W.
Harbor
Twins
Cousins
McVay Rock
Packsaddle Mtn
CRISSEY AIRPORT
PELICAN BEACH STATE PARK
R. 12 W.
CURRY CO
DEL NORTE CO
R. 11 W.
R. 1 W.
R. 1 E.
Cone Rock
Hunter Rock
Prince Island
SMITH RIVER INDIAN RESERVATION
Hole in the Ground
Pine Flat Mtn


1983-MAP 6
Kerby
Tennessee Pass
Lime Rock
Cave Junction
Woodcock Mtn
Josephine Mtn
Hawks Rest
Canyon Pk
Lightning Gu
Rocky Bar Gul
Hansen Gul
Sucker Gul
Madison Gul
Doe Gap
Halfface Lake
Rough and Ready
Meadenhall
Siskiyou Smokejumper Base
Rough and Ready Creek Forest Wayside State Park
Buckskin Peak
Frantz Meadow
Biscuit Hill
Indian Hill
French Flat
O'Brien
Takilma
Waldo
Lone Mtn
Gilligan Bu
Stone Corral
Bain Station
Oregon Mtn
Scotch Gul
Trapper Gul
Lone Ridge
Beaver Ridge
R. 10 W.
R. 9 W.
R. 8 W.
R. 7 E.
R. 6 E.
R. 5 E.
R. 4 E.
R. 3 E.
OREGON
CALIFORNIA
State Quarantine Sta
Elk Valley
Haze View Summit
Monumental
Baker Flat
Cedar Trough Camp
High Dome
Rivers
Laurel Butte
Little Sanger Pk
Sanger Pk
Haystack
Chicago Peak
Camp Chicago
Monkey Cr
Old Patrick Cr Sta
Shelley Cr
Horse Flat
Highway Maint Sta
Polar Bear Mtns
Forest
199
182
18N07
46


1983-MAP 7
Lit Grayback Pk
Cedar Flat
Holcomb Pk
Squaw Mtn
GAGING STATION
GRAYBACK CAMP
Grayback
Little Sugarloaf (Pk)
Low Divide
Big Sugarloaf Pk
Windy Gap
Grayback Mtn
Holland
California Bar
Buck Pk
CAVE CREEK
OREGON CAVES NATL MON
Lake Mtn
Lakin Mtn
Mt Elijah
Horse Mtn
Serpentine Flat
Number Seven Gul
Number Eight Gul
Deadman Gul
Number Eight Pk
Taylman Gulch
Elkhorn Prairie
Fish Lake
ROGUE RIVER
Lit Craggy Pk
Craggy Mtn
NATIONAL FOREST
Johnson Pt
Portuguese Flat
Whiskers Pk
Swan Mtn
Green Valley
Grizzly Pkt
Bolan Mtn
Kings Saddle
Arthouse Mtn
Weston Mtn
Tannen Mtn
Green Mdw
Lake Peak
Low Gap
Sucker Cr Gap
R 7 W
R 6 W
R 5 W
SISKIYOU CO
Humboldt Meridian
T 19 N
T 18 N
R 6 E
R 7 E
Spees Peak
Bare Mtn
Pyramid Peak
Phantom Mtn
Figurehead Mtn
Cedar Basin
Fir Glade
Bean Gulch
Sweaty Glade
Little Grayback
Porters Camp
KLAMATH
Poker Flat
Tom Gray
Fourmile Butte
Fourmile Creek
Morgan Creek
Bear Wallow Camp
Mt Diablo
NATIONAL FOREST